



# UNITED STATES PATENT AND TRADEMARK OFFICE

H.A

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/607,216

06/27/2003

Atsuko Kawasaki

09108.0002

5695

22852 7590 07/03/2006

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER  
LLP

901 NEW YORK AVENUE, NW  
WASHINGTON, DC 20001-4413

EXAMINER

DIAZ, JOSE R

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 07/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/607,216

Applicant(s)

KAWASAKI ET AL.

Examiner

José R. Díaz

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 April 2006.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-5 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-5 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 4/13/06.  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.  
5) ☐ Notice of Informal Patent Application (PTO-152)  
6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 2-3 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is not clear to the examiner whether the silicon oxide recited in claims 2-3 is a new additional layer or the same oxide film or layer recited in claimed 1. Clarification is required. Please note that the examiner, in the rejections presented below, considers the oxide layer of claim 2-3 as to be the same silicon oxide layer as recited in amended claim 1.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ahn (US Pat. No. 6,596,607 B2) in view of Applicant's admitted prior art.

Regarding claim 1, Ahn teaches a method of producing semiconductor devices, comprising the steps of:

forming an etching resistive mask (consider the oxide film 101 and the nitride film 103) over a semiconductor substrate (100) (see fig. 5 and col. 4, lines 3-6);

etching said semiconductor substrate through an opening in said etching resistive mask to form a device isolation trench (121) (see fig. 5 and col. 4, lines 7-8 and 13-16);

forming a silicon oxide layer (109) over said the etching resistive mask and the semiconductor substrate having said device isolation trench formed therein (see fig. 6);

forming a coat of a silazane perhydride polymer solution to form a silicon oxide film ("polysilazane" 119)<sup>1</sup> over the silicon oxide layer (109);

removing said film of the silicon oxide film (119), except for a residue of silicon oxide (removing an upper part of the oxide layer) remaining inside said device isolation trench (see fig. 7 and col. 4, lines 48-52); and

after removing said film, heating (curing) said residue (see col. 4, lines 53-55).

However, Ahn fails to teach to teach the steps of vaporizing a solvent from said coat and then subjecting said coat to chemical reaction to form the silicon oxide film. In addition, Sato et al. fails to teach the limitation "removing impurities for densification."

Applicant teaches that it is well known in the art that a polysilazane silicon oxide film is formed from a coat of a silazane perhydride polymer solution, in which a solvent from said coat is vaporized [page 1, lines 35-36] and then, the silicon oxide film is formed by subjecting the coat to chemical reaction [see page 1, lines 33-35 and page 2,

---

<sup>1</sup> Please note that "silazane perhydride polymer" and "polysilazane" have the same chemical composition. For instance, Koyanagi (US Pat. No. 6,191,002 B1), column 8, line 1, discloses  $[(\text{SiH}_2\text{NH})_n]$  as the composition for the "silazane perhydride polymer", and Nishiyama et al. (US 2003/0022522 A1) also discloses the same composition in paragraph [0052] for "polysilazane."

lines 2-3]. In addition, Applicant teaches that impurities are removed during the heating step [page 2, lines 4-6].

Applicant's admitted prior art and Ahn are analogous art because they are from the same field of endeavor as applicant's invention. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form a silicon oxide film from a coat of a silazane perhydride polymer solution by vaporizing a solvent from said coat and subjecting said coat to a chemical reaction; and to heat the silicon oxide to further remove impurities for densification. The motivation for doing so, as is taught by Applicant's admitted prior art, is to reduce crack formation in the silicon oxide film (page 2, lines 10-12). Therefore, it would have been obvious to combine Ahn with Applicant's admitted prior art to obtain the invention of claim 1-4.

Regarding claims 2-3, Ahn teaches a silicon oxide film (109) over the surface of the etching resistive mask containing silicon nitride (103) (see fig. 6), after the formation of the device isolation trench (121) (see figs. 5-6), before forming the coat of silazane perhydride polymer solution (119) (see fig. 6 and col. 4, lines 20-27 and 32-35), and after etching said silicon nitride (103) to etch back opening edges (see fig. 5 and col. 4, lines 8-10 and 13-15).

Regarding claim 4, Ahn further teaches that the silicon oxide layer is formed by low pressure CVD (see col. 4, lines 20-23).

5. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ahn (US Pat. No. 6,596,607 B2) in view of Applicant's admitted prior art, and further in view of Koyanagi (US Pat. No. 6,191,002 B1).

Regarding claim 5, a further difference between the prior art and the present application is removing the film of silicon oxide by CMP.

Koyanagi teaches that it is well known in the art to polished by a CMP process a silicon oxide (4) formed by a heat treatment of the coat of a silazane perhydride polymer solution (7) (see col. 8, lines 61-63).

Applicant's admitted prior art, Ahn and Koyanagi are analogous art because they are from the same field of endeavor as applicant's invention. At the time of the invention it would have been obvious to a person of ordinary skill in the art to remove silicon oxide by CMP. The motivation for doing so, as is taught by Koyanagi, is to flat the top surface of the oxide film (col. 8, lines 65-67). Therefore, it would have been obvious to combine Koyanagi with Ahn and Applicant's admitted prior art to obtain the invention of claims 5.

### ***Response to Arguments***

4. Applicant's arguments with respect to claims 1-5 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

### ***Correspondence***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to José R. Díaz whose telephone number is (571) 272-1727. The examiner can normally be reached on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on (571) 272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

José R. Díaz  
Examiner  
Art Unit 2815



N. DREW RICHARDS  
PRIMARY EXAMINER